CLAIMS

We claim:

1.   A method of reducing the shop time of locomotives at a locomotive maintenance facility comprising:

    providing data gathering systems onboard a locomotive and a historical data base of locomotive system data on a plurality of similar locomotives, said data base being stored off-board of said locomotive, and said locomotive system data being selected from the group consisting of ambient air temperature, train notch, total track and force power, total voltage, total amps, software versions, engine RPM, engine temperature, crankcase pressure, dynamic braking, battery voltage, and voltage and amperage for all auxiliary motors;

    obtaining onboard locomotive systems data with said onboard data gathering systems during operation of said locomotive, prior to arrival of said locomotive at a locomotive maintenance facility for scheduled maintenance;

    transmitting said onboard systems data via wireless communications to a remote data center prior to arrival of said locomotive at said maintenance facility;

    prior to arrival of said locomotive at said maintenance facility, comparing said onboard system data with said historical data base to determine whether any of said onboard system data is out of a predetermined range or is within said predetermined range, but exhibiting a trend toward being out of said range;

    prior to arrival of said locomotive at said maintenance facility, assigning at least one fault code corresponding to at least one system fault based on said onboard systems data being either out of said range or exhibiting a trend toward being out of said range, said at least one fault code being selected from the group consisting of overcurrents, flashovers, crankcase overtemperatures, crankcase overpressures, communication failures, electrical ground failures, air conditioner converter failures,

30   propulsion system faults, auxiliary system faults, propulsion motor

31   faults, auxiliary motor faults, auxiliary system charging faults, engine

32   cooling system faults, oil system faults, control wiring faults, and

33   microelectronics faults;

34   prior to arrival of said locomotive at said maintenance facility, determining

35   any maintenance and repair operations to be performed when said

36   inbound locomotive arrives at said maintenance facility, in response to

37   said at least one fault code; and

38   communicating said determination of maintenance and repair operations to

39   said maintenance facility before said locomotive arrives at said

40   maintenance facility.

1   2.   The method recited in claim 1, further comprising classifying each said

2 maintenance and repair operation into a classification selected from the group

3 consisting of required, advisable, and optional operations, prior to arrival of said

4 locomotive at said maintenance facility.

1   3.   The method recited in claim 1, wherein said onboard systems data is

2 determined to be within said predetermined range, but exhibiting a trend toward being

3 out of range, by comparing a series of values for a given parameter over a period of

4 time.

1   4.   The method recited in claim 1, wherein said historical data base is

2 comprised, at least in part, of data collected from prior downloads of onboard systems

3 data.

1   5.   The method recited in claim 1, wherein said remote data center is

2 located at said remote maintenance facility.

1   6.   A system for reducing the shop time of locomotives at a locomotive

2   maintenance facility comprising:

3   a plurality of data gathering systems onboard a locomotive, said data gathering

4   systems being adapted to obtain onboard locomotive systems data

5   during operation of said locomotive, prior to arrival of said locomotive

6   at a locomotive maintenance facility for scheduled maintenance;

7   a computer off-board of said locomotive, said computer storing a historical

8   data base of locomotive system data on a plurality of similar

9   locomotives, said locomotive system data being selected from the

10   group consisting of ambient air temperature, train notch, total track and

11   force power, total voltage, total amps, software versions, engine RPM,

12   engine temperature, crankcase pressure, dynamic braking, battery

13   voltage, and voltage and amperage for auxiliary motors;

14   a wireless communication system, said wireless communication system being

15   adapted to transmit said onboard systems data to a remote data center

16   prior to arrival of said locomotive at said maintenance facility;

17   data comparison software adapted to compare said onboard system data with

18   said historical data base prior to arrival of said locomotive at said

19   maintenance facility, to determine whether any of said onboard system

20   data is out of a predetermined range or is within said predetermined

21   range, but exhibiting a trend toward being out of said range;

22   fault code assignment software adapted to assign, prior to arrival of said

23   locomotive at said maintenance facility, at least one fault code

24   corresponding to at least one system fault based on said onboard

25   systems data being either out of said range or exhibiting a trend toward

26   being out of said range, said at least one fault code being selected from

27   the   group   consisting   of   overcurrents,   flashovers,   crankcase

28   overtemperatures, crankcase overpressures, communication failures,

29   electrical ground failures, air conditioner converter failures, propulsion

30   system   faults,   auxiliary   system   faults,   propulsion   motor   faults,

31   auxiliary motor faults, auxiliary system charging faults, engine cooling

9

32	system faults, oil system faults, control wiring faults, and
33	microelectronics faults; and
34	diagnostic software adapted to determine, prior to arrival of said locomotive at
35	said maintenance facility, any maintenance and repair operations to be
36	performed when said inbound locomotive arrives at said maintenance
37	facility, in response to said at least one fault code;
38	wherein said wireless communication system is adapted to transmit said
39	determination of maintenance and repair operations to said remote data
40	center prior to arrival of said locomotive at said maintenance facility.

1   7.   The system recited in claim 6, further comprising classification
2   software adapted to classify each said maintenance and repair operation into a
3   classification selected from the group consisting of required, advisable, and optional
4   operations, prior to arrival of said locomotive at said maintenance facility.

1   8.   The system recited in claim 6, wherein said data comparison software
2   determines that said onboard systems data is within said predetermined range, but
3   exhibiting a trend toward being out of range, by comparing a series of values for a
4   given parameter over a period of time.

1   9.   The system recited in claim 6, wherein said historical data base is
2   comprised, at least in part, of data collected from prior downloads of onboard systems
3   data.

1   10.   The system recited in claim 6, wherein said remote data center is
2   located at said remote maintenance facility.